So one can see that there have been winters which were as dry as the last one. These dry winters were for the greatest part cold rather than warm; on the contrary, the last one was warm.

*Level of the Lake Geneva.*—This level is exceptionally low at the present time. We only find such low waters at the end of the winter of 1840, in March and in April. The level was at that time the same as it was on March 15 to 18 of this year.

*Duration of the absolute dryness.*—As we have seen, there had fallen 14 millimeters of rain on February 1 and 2, 1921. After that, we have had 41 days of absolute dryness, that is to say, until March 17, 1921. This is not the longest period of drought we have had; during the winter of 1896 we had a period of 41 days without rain.



## ANOTHER NOTE IN REGARD TO THE PRIMARY CAUSE OF COLDS.

A former note [1] on this subject by John R. Weeks declares, that the conclusions [2] arrived at by C. M. Richter at the end of his paper on "Colds and their relation to the physics of the atmosphere," do not seem to be in accord with the most recent medical thought. Conclusion No. 1 in question reads: "Acute coryza, commonly called a 'cold,' depends for its development primarily on an excess of moisture in the air we inhale." The most recent medical thought, as expressed for instance in a 1920 edition of a standard textbook [3] refers to the primary cause of acute rhinitis (common colds) as follows: "Its most conspicuous cause is exposure to drafts of air and to the influence of the atmospheric vicissitudes that are especially prevalent during the winter and spring seasons." As we know, winter and spring are likewise the seasons for cyclonic weather. The textbook adds: "Hence local disturbances of the circulation due to exposure are to be regarded as the accidental means of preparing the soil for bacterial invasion." One of the conclusions (No. 6) in question states this same fact. The question of a bacillus rhinitis (Tunnicliff) may be considered as remaining in the experimental stage, although recent investigations disprove the pathogenic quality of the Tunnicliff bacillus for acute rhinitis (Hall [4]) and also discredit a filtrable virus as the cause of either common colds or influenza (Branham and Hall [4]).

In Mr. Weeks's note it is stated, that the expired air being "normally near the saturation point"—that "therefore saturated air per se can not cause a discharge from the mucous membranes." This process is much more complicated than these words would indicate and I may refer here to the following words of Dr. L. Hill [5]: "The air, which is breathed into the lungs, whatever be its content of moisture or temperature, is breathed out approximately at body temperature and saturated with moisture at this temperature. Cold saturated air is excessively dry when warmed up to body temperature and takes up much moisture from the body, warm saturated air (or even half saturated) far less. The breathing of cool air entails, then, much greater evaporation from respiratory membrane and consequent greater flow of lymph through and secretion of fluid from it. The membrane is better washed and kept clean from infecting microbes by such outflow." This latter assumption is contradicted by an eminent physician, the late Abraham Jacobi,[6] who states: "As long as the mucous membranes are in their normal condition the germs can not enter the tissues and the circulation. A catarrh removes this protection; the epithelia are swept away by the fluid. That is the chance for the living enemies."

If we consider, that about every five seconds 500 cc., more or less, of incoming air is trying to replace a similar amount of expired air inside the nasal cavities and the lungs, it seems clear, that such air must be subject to considerable mixing.

A change of vapor pressure of this mixed air must tax the vasomotor apparatus of the mucosa constantly. The export of moisture (Rubner [7]) at a mean temperature and humidity of the room air by the lungs of an adult per hour amounts to 17 gm. when resting, 19 gm. when deep breathing, 34 gm. when singing. Rubner found the evaporation value of the lungs at 77° F. and 6 per cent relative humidity to be 18.4 and at 81 per cent relative humidity to be 10.9 gm. It seems, that we are not materially affected even by a large export of moisture from our lungs, as long as the air is rather dry. It is a different matter when the incoming air contains such a surplus of aqueous vapor, that evaporation by the lungs becomes rather impossible (Hann [8]). Such a condition would seem to call for special aid by the vasomotor nervous system, which acts as a reflex apparatus. "The automatic work of this system, by dilating or contracting vessels under its control, regulates the outflow of heat, of serum, of mucus into the nasal cavities. Generally the moisture inside the nose appears to be insensible, similar to the perspiration insensibilis of the epidermis, but any unusual increase of moisture, brought by the inhaled air, may increase the swelling of the hygroscopic swell bodies of the mucosa to such an extent, that the reflex apparatus by dilating the blood vessels may cause an overflow of the reservoir" (Richter.[9]).

It is to be hoped that some experimental work may overcome the difficulty of determining the vasomotor work of the nasal mucosa under the varying vapor pressure conditions of the incoming and outgoing air. Until then we have to accept the fact that the nasal mucosa, as a hygroscopic substance, will share the hygroscopic nature of other organic substances, like wood for instance. The human vasomotor apparatus of the nose of course varies in its sensitiveness. When unusually sensitive to changes in its area, it may try at once to get rid of an excess of moisture by sneezing, or simply by dilating its blood vessels. Such a vasomotor rhinitis is well known. Acute coryza will depend to a great extent on the sensitiveness of the vasomotor system. Experience teaches that it develops principally at the beginning of or during the passage of a cyclonic weather condition and that it seems to be therefore primarily due to the effect of an excess of moisture in the air.

Any weather condition that is associated with an increase of the aqueous vapor content of the air—and this is typical of the cyclonic weather condition—will necessarily increase the water content of the hygroscopic nasal mucosa and will induce an increased secretion from it. This effect will be minimal and rather insensible in general, but it will favor a more or less increased "running of the nose" in proportion to the degree of sensitiveness of the individual vasomotor apparatus. The functioning of this apparatus, however, depends besides on many factors that influence the general condition of an individual.—*C. M. Richter.*

[1] Weeks, John R.: Note in regard to the primary cause of colds. MO. WEATHER REV., December, 1920, 48: 690.
[2] Conclusions republished in MO. WEATHER REV., September, 1920, 48: 507.
[3] Anders, J. M.: Textbook of the practice of medicine, 14th Ed., 1920.
[4] *Journal of Infectious Diseases*, Chicago, February, 1921, 28: No. 2.
[5] Hill, Leonard: Atmospheric environment and health. MO. WEATHER REV., December, 1920, 48: 687-690.
[6] Jacobi, A.: Colds. *N. Y. Medical Journal*, Mar. 16, 1912.
[7] Rubner: Lehrbuch der Hygiene, 1907.
[8] von Hann, J.: Klimatologie, 1908.
[9] Richter, C. M.: Colds and their relation to the physics of the atmosphere. *Medical Record*, Dec. 6, 1913.

### A BRIEF REPLY.

In his note to which Dr. Richter refers, the writer was restricted by the editor to only a few lines. It was, of course, impracticable to enter into a discussion and only a few words need be said now.

1st. I am glad to see that Dr. Richter accepts the bacterial nature of colds in general.

2d. I do not find in his quotation from Anders any statement that a *common* cold "depends for its development primarily on an excess of moisture in the air we breathe;" and I have nowhere seen concrete evidence that common colds are associated with "cyclonic weather."

3d. It is admitted that *some* persons are subject to harm from drafts; *some* persons have hay fever and rose colds; *some* persons have acute rhinitis because of occupational association with chemicals; and so on. But where do *most* people get their colds? The most recent and perhaps best authority that I have seen is the Hand Book of Therapy, 6th edition, October, 1920, published by the American Medical Association. On page 224 it says:

"Acute colds are always due to germs of some kind. A too dry atmosphere, which is the condition in so many houses to-day, may so irritate or congest the nostrils as to allow the least irritant to cause at first a simple inflammation of the mucous membrane, which congested area may later pick up and harbor, or cease to kill, germs. Outdoor air does not predispose to colds as much as indoor air, and persons whose occupation is indoors are more liable to have colds than those whose occupation is outdoors. * * * It is quite probable that chilling of the surface of the body congests the inner organs and possibly the mucous membrane of the air passages. If the mucous membrane of the nose is congested, it more readily becomes inflamed. * * * Some persons can not be exposed to a single draft on any part of the body without an acute coryza starting. * * * Other persons who do not have this susceptibility may become chilled, may be subjected to violent, cold, damp winds, and may even get wet and still never develop a nasal inflammation."

For recent experimental work see *Jour. A. M. A.;* **75:** 1500 E and note on another page of this magazine.—*John R. Weeks.*

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### NOTE ON SOME EFFECTS OF WEATHER CHANGES ON DISEASE.

The conditions of the vasomotor nerves of the skin and of the blood supply to the capillaries of the skin have much to do with the amount of blood that reaches other organs and surfaces of the body and thus with disease "feelings" and bacterial activity. Experiments on animals have recently demonstrated (1) that chilling of the body surface causes an anaemia of the mucous membranes of the nose and throat instead of a hyperemia as formerly supposed (2). Further, there is recent evidence (3) that "nerve impulses along vasomotor fibers may play upon the caliber not only of the arterioles but also of the capillaries and venules." Again, for example (4), if the splanchic nerves on the two sides are cut the intestinal region becomes congested and the effect in this case is so great that the general arterial pressure falls to a very low point.

The cause of "weather pains" in persons with arthritis, "rheumatism," fractures, amputated limbs, etc., has been a mystery. Dr. Pemberton, of the Presbyterian Hospital, Philadelphia, has thrown new light on the subject by the study of 400 cases of chronic arthritis under treatment in the Army (5). Arthritis is usually due to focal infection and is popularly called "rheumatism." Dr. Pemberton states that the blood supply of the joints, per se, in health as well as disease, is definitely poor and quotes the researches of Nichols and Richardson (6) also to that effect. It follows that further diminution of the blood supply to these parts by the action of weather conditions will cause an increase of rheumatic sensations and of bacterial activity in localities that are depleted, such as joints, fractures, amputations, and the mucous membranes of nose and throat. Respiratory functions of the blood are also a factor (oxygen content, etc.), and Dr. Pemberton says:

It has long been known that chronic sufferers from this disease (arthritis) undergo exacerbations that seem to be sharply related to disturbances of the weather. This is so definitely true that certain types of climate are recognizedly detrimental and others equally advantageous in their influence on this disease. If disturbance in the respiratory functions of the blood is a factor in the disease, it is almost axiomatic that wide fluctuations of the barometer and humidity would affect these cases, since the percentage saturation of hemoglobin by oxygen is a function of the partial pressure of oxygen in the alveolar air.

Following another line of investigation, E. G. Martin, of Stanford University (7), has found that the most obvious of the external factors that influence the daily work of factory employees are climatic, confirming in this respect the previous work of Ellsworth Huntington, of Yale University. It appears (to quote the review in the Journal of the American Medical Association) that certain days are more favorable to high output than others, and the influences that underlie the differences are such as to affect all workers in a single environment. Martin's data, as well as Huntington's and the studies of the New York Ventilation Commission, suggest that the temperature at which work is carried on is important. He shows that there is evidence that persistent exposure to temperature above 30 C. (86° F.) is unfavorable to strength. Relative humidities between 70 and 80 per cent appear to favor high strength showing.—*John R. Weeks.*

#### References.

(1) Jour. A. M. A.: *75*, p. 1500 E.
(2) Mo. Wea. Review, *48*, 9; pp. 507, 508.
(3) Jour. A. M. A.; *75*, 26 (Dec. 25, 1920), p. 1784.
(4) **Howell,** Physiology, 7th ed., 1918. p. 613.
(5) Jour. A. M. A.; *75*, 26 (Dec. 25, 1920), pp. 1761–1765.
(6) **Nichols, E. H.,** and **Richardson, F. L.,** Jour. A. M. A., *21*, 149, September, 1909.
(7) **Martin, E. G.,** Strength Tests in Industry, Pub. Health Rep., *35*, 1895 (Aug. 13, 1920).

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### WEATHER AND DISEASE.

The article by Dr. Leonard Hill on "Atmospheric Environment and Health" that appeared in the Monthly Weather Review for December, 1920, is, in the main, of high standard, but I think that exception can be taken to the first sentence. It is an old thought that things wild are free from contagious disease and disease epidemics, just as it is an old thought that night air, and even air in general, is a carrier of contagion. The American Indian and the Esquimaux were subject to consumption before the arrival of civilization as well as now. Wild animals and wild plants now have contagious diseases and doubtless always did have them. Bacteria of types now common are found in the oldest manuscripts, thousands of years old, embedded in the papyrus and clay, and in rocks of prehistoric times. Doubtless the cave dwellers of the glacial period were afflicted and the plants and animals. Bacteria are found deeply imbedded in the ice of newly exposed arctic regions.

Dr. Erwin Smith, director of the Laboratory of Plant Pathology, United States Department of Agriculture, believes that all plant families will ultimately be found to have characteristic bacterial diseases, though we now know only some of those that are most common.